



Forest Insect & Disease Management

Survey Report

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DUTCH ELM DISEASE
CHEQUAMEGON NATIONAL FOREST, WISCONSIN
USING REMOTE SENSING



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INTRODUCTION

The Chequamegon National Forest, located in northern Wisconsin, encompasses approximately 830,000 acres. The northern hardwood and elm-ash type comprise approximately 28 percent of the forested acreage. Since there is a substantial volume of elm on the area and the status of Dutch elm disease (DED) was unknown, the St. Paul Field Office was requested by the Chequamegon National Forest to conduct an evaluation of the situation around Mellen, Wisconsin and the Chequamegon Flowage.

OBJECTIVE

The objective was to determine the current volume impact of Dutch elm disease on parts of the Chequamegon National Forest.

METHODS

During August 1975, 33 miles of imagery were flown on the Yellow River and part of the Chequamegon Flowage and 30 miles of imagery southwest of Mellen, Wisconsin at a scale of 1:8000 using an RC-10 camera mounted in an Aero Commander. The photography was taken by Aviation Management, R-9, Milwaukee, Wisconsin. Fourteen miles of imagery flown during July at a scale of 1:10,000 for flooding on the Chequamegon Flowage were also used in the evaluation. The imagery was a 9-inch color infrared transparency format type. The photographed areas were plotted on a one-half-inch-to-the-mile map for area identification and ground reference data. Each image was interpreted for the number of dead and dying elm trees. Thirty infection centers were selected for ground truth correlation. The diameter at breast height (d.b.h.), number of logs, tree condition and species were recorded for each tree at each center. All photo interpretation data were adjusted using linear regression data obtained from the ground truth comparisons.

The average volume for dead and dying elm and standard error of the mean were calculated using volumes obtained from the ground truth data collection. The average volumes were then applied to the total number of dead and dying elms on the remote sensed area.

RESULTS AND DISCUSSION

The interpretation of the transparencies revealed that Dutch elm disease is distributed throughout the area. Mortality is high throughout the area around Perkinstown (Figure 1), high within 3 miles of Mellen, but lower in the remaining area photographed around Mellen (Figure 2). The elm resource within 3 miles of Mellen and in the bottomlands along the Yellow River and Chequamegon Flowage has been substantially reduced by the Dutch elm disease but there is a considerable volume of live elm throughout the remaining area photographed.

Of the 48,675 acres remote sensed, 2,575 acres were classified as elm mortality areas (Table 1). About 1,025 acres were classified as heavy mortality on National Forest land and 375 acres on private land within the Forest boundary.

Eight hundred and eighty five acres were classified as moderate to light on National Forest land and 290 acres on private lands within the Forest boundary. Heavy mortality was defined as an average of more than 1 tree/acre; moderate to light mortality was defined as between 0.9 trees/acre and 1 tree/10 acres. Five acres was the smallest unit examined. Of the 4,042 elm trees dead or dying on the 2,575 acres, 34 percent were dying, 64 percent were dead and 2 percent were dead or dying from causes other than Dutch elm disease.

The volume loss in the survey area is 303,840 board feet of dead standing elm plus 168,130 board feet of elm that died in 1975 (Table 2). The annual rate of mortality should increase each year until the elm resource is reduced to a low level at which time the annual rate will decline. An 80% elm mortality of the total elm resource is expected by 1995 for the Chequamegon National Forest. A map of the mortality areas and total flight areas is provided in Figures 1 and 2.

MANAGEMENT CONSIDERATIONS

The following action plan is recommended to reduce the rate of Dutch elm disease spread and mortality.

1. Establish and keep current a map of all Dutch elm disease on the Forest.
2. Develop elm harvest zones. (When possible, harvest during September to December to help reduce beetle populations and the rate of spread.)
 - a. Establish Red zones within 1 to 2 miles* of known infection centers (20 trees or more). Initiate accelerated harvest of elm resource within this zone.
 - b. Establish Yellow zones within 2 to 6 miles* of known infection centers. Initiate an accelerated harvest of valuable elm stands and conduct an inventory of the remaining elm resource.
 - c. Establish Blue zones within 6 to 15 miles* of known infection centers. Conduct normal sales operation. Maintain an intensive inventory of the elm resource for future harvest information.
3. Limit shipment of elm logs with bark intact to September - December when possible.

* Distance should be adjusted to coincide with management objectives.

4. Eliminate stockpile of elm logs at mills or in the forest during May - July when possible. Debarked or chipped elm wood is safe at any time.

Table 1. Extent and intensity of elm mortality, Chequamegon National Forest, 1975, (in acres).

Area	Area Photographed	Heavy Mortality		Moderate to Light Mortality	
		National Forest	Private	National Forest	Private
Mellen	20,000	175	325	275	175
Perkinstown	28,675	850	50	610	115
Total	48,675	1,025	375	885	290

Table 2.--Number and volume of dead and dying elm by area, Chequamegon National Forest, Wisconsin, 1975.

Area	No. Dead Elm Trees		No. Dying Elm Trees		Mortality Other Unknown		Volume Board Feet			
							Dead Elm		Dying Elm	
	NF ^{2/}	PVT ^{3/}	NF	PVT	NF	PVT	NF	PVT	NF	PVT
^{1/} Mellen	183	211	99	114	4	5	33,480 ± 2,190	23,630 ± 2,530	12,770 ± 1,480	12,760 ± 1,710
^{1/} Perkinstown	1,951	252	1,043	140	35	5	218,510 ± 23,410	28,220 ± 3,020	124,540 ± 15,645	18,060 ± 2,100
Total	2,134	463	1,142	254	39	10	251,990 ± 25,600	51,850 ± 5,550	137,310 ± 17,125	30,820 ± 3,810

^{1/} All data adjusted using linear regression (correlation .89).

^{2/} National Forest.

^{3/} Private.

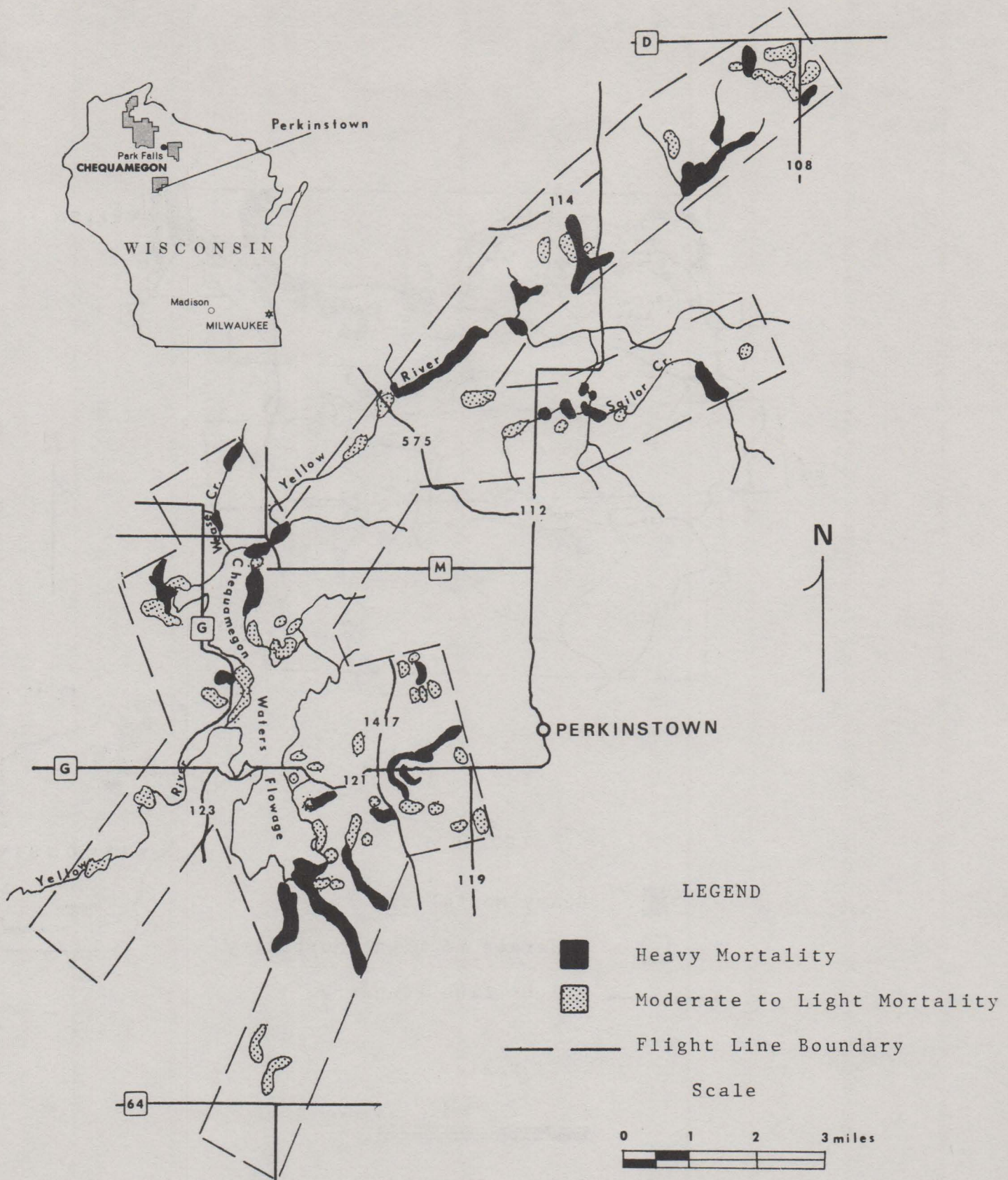


Figure 1. Dutch elm disease along parts of the Yellow River and Chequamegon Flowage, Chequamegon National Forest, Wisconsin.

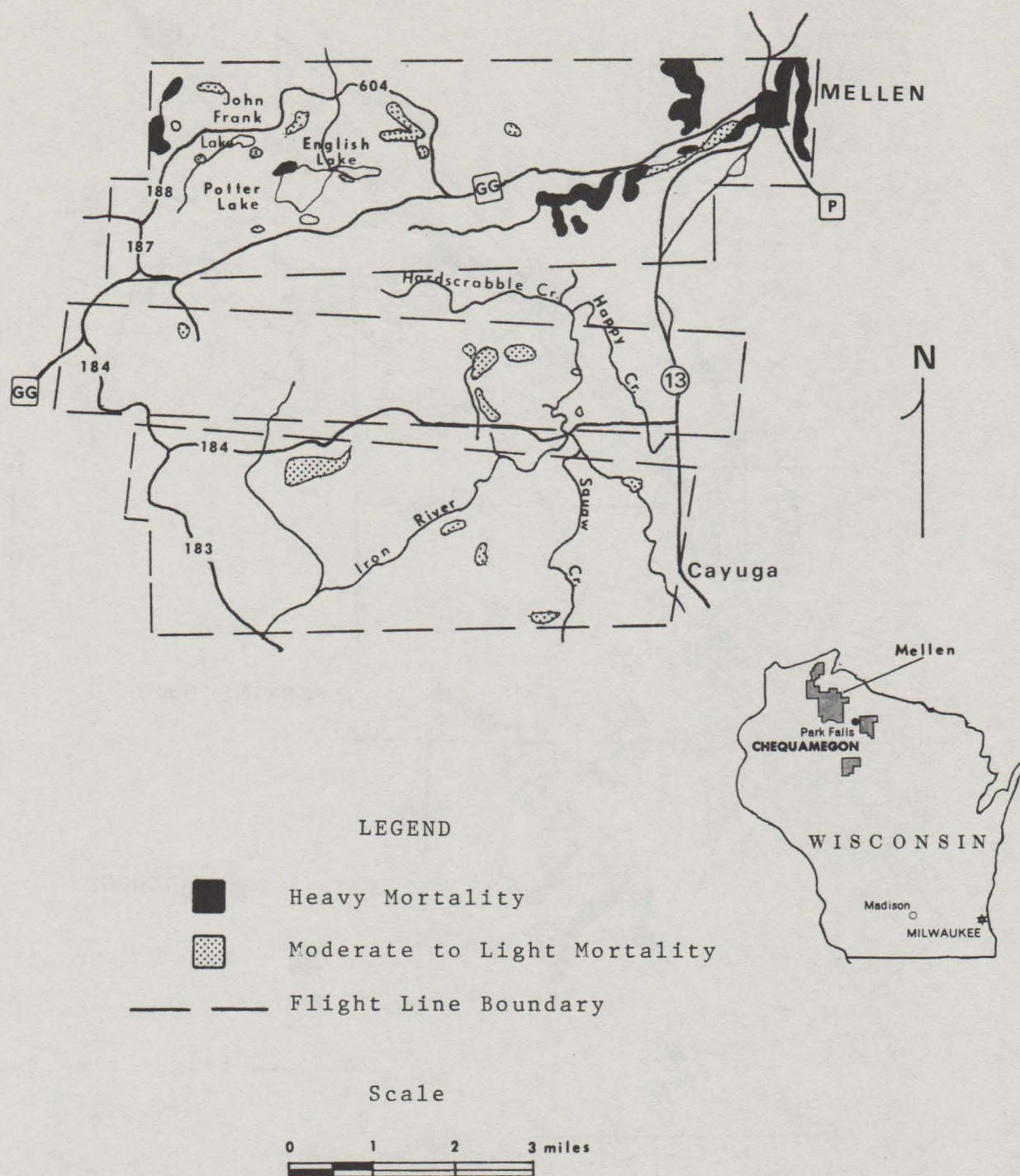


Figure 2. Dutch elm disease southwest of Mellen, Wisconsin.